

## WHAT IS CLAIMED IS:

## 1. A failure diagnosing apparatus comprising:

a first sensor for detecting a temperature of cooling water of an  
5 engine mounted on a vehicle;

a second sensor for detecting a temperature associated with the  
engine;

a first calculating means for calculating a first difference between a  
temperature detected by the first sensor at the time when the engine stops  
10 in a previous operating cycle of the engine and a temperature detected by  
the first sensor at the time when the engine starts in a current operating  
cycle of the engine;

a second calculating means for calculating a second difference  
between a temperature detected by the second sensor at the time when the  
15 engine stops in the previous operating cycle and a temperature detected by  
the second sensor at the time when the engine starts in the current  
operating cycle; and

a determining means for determining whether the first sensor is  
faulty based on the first difference and the second difference.

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2. The failure diagnosing apparatus of claim 1, wherein the determining  
means determines that the first sensor is faulty if a magnitude of the first  
difference is less than a predetermined value when a magnitude of the  
second difference is greater than a predetermined value.

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3. The failure diagnosing apparatus of claim 1, wherein the temperature  
associated with the engine includes a temperature of air that is introduced  
into the engine.

4. The failure diagnosing apparatus of claim 1, wherein the determining means determines that the first sensor is normal if a magnitude of the first difference is greater than a predetermined value.
- 5 5. The failure diagnosing apparatus of claim 1, wherein the determining means prohibits the determination that the first sensor is faulty if a magnitude of the first difference is less than a predetermined value when a magnitude of the second difference is less than a predetermined value.
- 10 6. The failure diagnosing apparatus of claim 1, further comprising a permitting means for permitting the determination that the first sensor is faulty if a possibility of a failure of the first sensor is detected in the previous operating cycle.
- 15 7. The failure diagnosing apparatus of claim 6, wherein the permitting means determines the possibility of a failure of the first sensor if at least one of the following conditions is met:
- 1) a temperature detected by the first sensor does not change although a temperature detected by the second sensor changes;
  - 20 2) a temperature detected by the first sensor does not change over a predetermined time period; and
  - 3) a temperature detected by the first sensor does not change although a predetermined amount of heat from the engine is observed.
- 25 8. A method for diagnosing a failure of a first sensor that detects a temperature of cooling water of an engine mounted on a vehicle, the vehicle comprising a second sensor that detects a temperature associated with the engine, the method comprising the steps of:
- calculating a first difference between a temperature detected by the

first sensor at the time when the engine stops in a previous operating cycle of the engine and a temperature detected by the first sensor at the time when the engine starts in a current operating cycle of the engine;

calculating a second difference between a temperature detected by  
5 the second sensor at the time when the engine stops in the previous operating cycle and a temperature detected by the second sensor at the time when the engine starts in the current operating cycle; and

determining whether the first sensor is faulty based on the first difference and the second difference.

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9. The method of claim 8, wherein the step of determining further comprises the step of:

determining that the first sensor is faulty if a magnitude of the first difference is less than a predetermined value when a magnitude of the  
15 second difference is greater than a predetermined value.

10. The method of claim 8, wherein the temperature associated with the engine includes a temperature of air that is introduced into the engine.

20 11. The method of claim 8, wherein the step of determining further comprises the step of:

determining that the first sensor is normal if a magnitude of the first difference is greater than a predetermined value.

25 12. The method of claim 8, wherein the step of determining further comprises the step of:

prohibiting the determination that the first sensor is faulty if a magnitude of the first difference is less than a predetermined value when a magnitude of the second difference is less than a predetermined value.

13. The method of claim 8, further comprising the step of permitting the determination that the first sensor is faulty if a possibility of a failure of the first sensor is detected in the previous operating cycle.

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14. The method of claim 13, wherein the permitting step further comprises the step of determining the possibility of a failure of the first sensor if at least one of the following conditions is met:

- 1) a temperature detected by the first sensor does not change although a  
10 temperature detected by the second sensor changes;
- 2) a temperature detected by the first sensor does not change over a predetermined time period; and
- 3) a temperature detected by the first sensor does not change although a predetermined amount of heat from the engine is observed.

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15. A computer program stored on a computer readable medium for use in diagnosing a failure of a first sensor that detects a temperature of cooling water of an engine mounted on a vehicle, the vehicle comprising a second sensor that detects a temperature associated with the engine, the computer  
20 program comprising:

program code for calculating a first difference between a temperature detected by the first sensor at the time when the engine stops in a previous operating cycle of the engine and a temperature detected by the first sensor at the time when the engine starts in a current operating  
25 cycle of the engine;

program code for calculating a second difference between a temperature detected by the second sensor at the time when the engine stops in the previous operating cycle and a temperature detected by the second sensor at the time when the engine starts in the current operating

cycle; and

program code for determining whether the first sensor is faulty based on the first difference and the second difference.

- 5 16. The computer program of claim 15, wherein the program code for determining further comprises program code for determining that the first sensor is faulty if a magnitude of the first difference is less than a predetermined value when a magnitude of the second difference is greater than a predetermined value.

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17. The computer program of claim 15, wherein the temperature associated with the engine includes a temperature of air that is introduced into the engine.

- 15 18. The computer program of claim 15, wherein the program code for determining further comprises program code for determining that the first sensor is normal if a magnitude of the first difference is greater than a predetermined value.

- 20 19. The computer program of claim 15, wherein the program code for determining further comprises program code for prohibiting the determination that the first sensor is faulty if a magnitude of the first difference is less than a predetermined value when a magnitude of the second difference is less than a predetermined value.

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20. The computer program of claim 15, further comprising program code for permitting the determination that the first sensor is faulty if a possibility of a failure of the first sensor is detected in the previous operating cycle.

21. The computer program of claim 20, wherein the program code for permitting further comprises program code for determining the possibility of a failure of the first sensor if at least one of the following conditions is met:

- 1) a temperature detected by the first sensor does not change although the temperature detected by the second sensor changes;
- 2) a temperature detected by the first sensor does not change over a predetermined time period; and
- 3) a temperature detected by the first sensor does not change although a predetermined amount of heat from the engine is observed.